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NOTES AND LITERATURE

HEREDITY

F. E. Lutz contributes a very interesting paper⁸ in which he presents evidence bearing on the effect of selection in a "pure" strain. Amongst wild flies of this species (*Drosophila ampelophila*) about one third of one per cent. present abnormalities in wing venation. By selection and inbreeding he was able to produce strains with practically 100 per cent. abnormality. In a good many crosses the abnormal venation behaved as a Mendelian recessive in which dominance of normal was not perfect. But in other cases the phenomena observed departed widely from the typical Mendelian behavior. The author suggests that the abnormality is due to a factor which has high fluctuating variability, and that these fluctuations are to a certain extent inherited. It is shown that Galton's law of ancestral inheritance does not apply to individual families, even when these are large (100 to 200 individuals).

If we knew the real cause of this abnormality we might possibly be able to reason about its peculiar behavior with some hope of elucidating it. Any attempt at explanation must necessarily be largely hypothetical. The writer would suggest that most of Lutz's data point to the presence of two factors for abnormality, one much stronger than the other, and one or both of them highly variable (fluctuating variability). Davenport found such a case (two factors, one stronger than the other), for the hood in certain fowls.⁹ The writer has often thought there ought to be cases of Mendelian factors which just barely give rise to visible expression in the soma. Since all characters exhibit fluctuating variability, such a factor should behave much as the character which Lutz studied.

Lutz concludes that he has produced effects by selection in "pure lines." This is much to be doubted. The results he secured by selection fit very well the curves shown in my paper on "Some of the Principles of Heredity Applied to Plant Breeding"¹⁰ for

⁸ "Experiments with *Drosophila Ampelophila* Concerning Evolution," F. E. Lutz, Carnegie Institution of Wash., 1911.

⁹ *Proc. Wash. Acad. Sci.*, "Lecture on Heredity," by C. B. Davenport.

¹⁰ Bulletin Bureau of Plant Industry, No. 165.

selection in dihybrids. Lutz's results seem to be further complicated by the fact, to which he calls attention, that the great variability of the character in question gave apparent normals that were really abnormals genetically, and this very fact rendered the establishment of really pure lines a matter of great difficulty, if indeed not an impossibility. A line is not necessarily pure (genetically) because it has descended through many generations of the closest possible inbreeding from a single original pair. It is only pure in a Mendelian sense when all its allelomorphs are duplex and the members of each pair of them are identical in character. An individual might be pure in this sense even though both its parents were complexly bred monogrels. On the other hand, if Lutz's original pair were not thus pure, their descendants would only by chance constitute a pure line. It is very doubtful if Lutz has really proved the effect of selection in modifying a pure line, for it is not established that he worked with a pure line, in the sense in which that term is now used.

Professor E. B. Wilson has recently published an excellent review of cytological investigations relating to sex inheritance.¹¹ There appears now to be no doubt of the relation of sex to certain chromosomes in dicecious organisms. This relation is also interpretable from the Mendelian viewpoint, so that we may say that sex inheritance belongs in the category of Mendelian phenomena. In nearly all organisms thus far studied the female is to be regarded as homozygous and the male heterozygous for sex. Hence the male produces two kinds of spermatozoa, while the females produce only one kind of egg. When an egg is fertilized by the one type of spermatozoa the zygote is a female; if by the other, the zygote is a male. In general, the female diploid nuclei contain two of the sex chromosomes or two groups of them when the sex chromatin element is compound. The nuclei of the male contain only one of these elements, with or without a synaptic mate different from it in character. In sea urchins it has been shown that it is the female that is heterozygous. But in this case the female possesses one of the sex elements and the male none. In both cases the female is characterized by an excess in the number of the sex elements as compared with the male.

A large number of ordinary Mendelian characters have been

¹¹ "The Sex Chromosomes," *Arch. f. Mikrosko. Anat.*, Bd. 77, 1911, pp. 249-271.

shown to be sex limited in inheritance in such a manner that it seems certain they are in some way connected either with the sex-determining chromatic element or with the synapctic mate of this element (in the heterozygous sex). This links these characters with the chromosomes, and further strengthens the chromosome theory of Mendelian inheritance.

The writer is fully aware of the danger, in dealing with statistical data, of drawing conclusions from insufficient data or from data that have not been submitted to a full mathematical analysis, such as the determination of means, norms, standard deviations, and coefficients of correlation. Although I have no very full or accurate data on the subject and have not actually determined statistically the coefficients of correlation between the characters about to be mentioned, I am of opinion, after more or less superficial observation extending now over nearly half a century, that there is a noticeable degree of correlation between positiveness of statement, and inaccuracy of statement. An illustration of this correlation will be found in a paper by Dr. J. Arthur Harris, published in the November (1911) number of this journal. It is now fairly well established that the norms of a group of related genotypes can, in some cases at least, be arranged in a frequency curve. In my review of de Vries's "The Mutation Theory"¹² I cite this fact *to show that the type of variation represented by these genotypes comes under the head of what de Vries there defines as "continuous variation,"* as opposed to the "discontinuous variation," in which the norms of the variants can not be thus arranged. In Dr. Harris's paper he represents me as having cited the fact that these genotype norms form a frequency curve as a *proof of the genotype hypothesis*. I have not been able to find the time to look up other similar citations in this paper to see whether the same inaccuracy applies to them. The type of correlation we are considering is further illustrated in this paper in Dr. Harris's definition of genotype, from which he omits the word "homozygous." The definition is further inaccurate in including clonal varieties under the definition of genotype. The author of the term genotype, in a recent lecture in this city, defined it as "the descendants of a single homozygous individual propagated by self-fertilization."¹³

¹² AMER. NAT., Dec., 1910.

¹³ Since the above was written it has been pointed out by several writers that the word genotype should be replaced, in the above sense, by "biotype" or "pure line."